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Subject: Bark Beetle Activity on the Bradshaw RD (bradshawrd)

To: District Rangers, Bradshaw RD, Prescott NF

On September 14, 2004, I visited three sites on the Bradshaw RD, Prescott NF, at the request of Gary Wittman and Ian Fox to evaluate the areas for bark beetle activity and stand susceptibility to beetle attack. This report will cover those areas plus an additional area visited earlier. The Forest is requesting prevention/restoration funds for these four areas in FY05. The areas include: 1) Alto Pit OHV, 2) Granite Basin recreation area, 3) Cold Springs WUI area, and 4) Horsethief Basin Summer Home area. This report will discuss current beetle activity on the Forest and at each proposed site, summarize silvicultural strategies to reduce future bark beetle activity and give recommendations to minimize future beetle impacts.

Bark Beetle Activity on the Prescott National Forest

Aerial detection surveys and ground surveys conducted by FHP, Arizona Zone office, have found high levels of bark beetle-killed ponderosa pine on the Prescott NF from 2001-2003. Beetle related pine mortality has dramatically declined in 2004 as indicated by our surveys. Two pine engraver species (*Ips lecontei* and *I. pini*) and to a lesser extent the western pine beetle (*Dendroctonus brevicornis*) are the primary causes of pine mortality. Much of the mortality in 2001-2003 occurred in conjunction with the recent drought and in the most tree stressed prone sites (south facing slope, sites with poor site quality, rocky, thin soil sites and sites in the lower pine transitional zone). In 2004 increased available moisture, coupled with the fact that many higher beetle susceptible sites have already experienced heavy tree losses, has resulted in a decline in beetle related pine mortality.

A detailed summary of the 2004 aerial detection survey results will be provided to the Forest at a later date; however, our preliminary analysis showed that ponderosa pine mortality only occurred on approximately 8,851 acres in 2004. This is down considerably from the 93,112 acres detected in 2003. This trend of decreased activity is similar to what has been observed in the majority of Arizona during 2004. There are still areas that are experiencing considerable pine mortality, with bark beetle populations still relatively high.

Bark Beetle Activity in Proposed Treatment Areas on the Bradshaw RD

The general area of Cold Springs has experienced moderate to high levels of beetle related tree mortality over the past few years. Brush crushing and other treatments have been used to reduce the amount of available fuels created by the recent beetle outbreak. Beetle activity in the proposed treatment area is at low levels, however stand conditions are at moderate to high susceptibility levels, Figure 1. Proposed treatments would thin ponderosa pine stands to 40-60



basal area. Also, any currently infested tree would be removed as part of the thinning treatment. This would assist in reducing overall stand susceptibility to beetle attack and crown fire.

The two recreation areas proposed for treatment, Alto Pit OHV and Granite Basin, have trees stressed due to repeated damage by campers and soil compaction caused by roads and large vehicles parking off-road. During periods of drought, which has been occurring the past few years, these trees can be particularly stressed and more susceptible to beetle attack. The high tree densities at these sites further exacerbates this condition Figure 2. A combination of these factors seems to be what has happened at other recreation sites on the District over the past few years where beetle related tree mortality has occurred. Both of these sites have current beetle activity in and adjacent to them. Proposed treatments would include thinning and sanitation tree removal. Higher basal areas would be maintained in the recreation sites; however deformed, damaged or diseased trees would be targeted for removal. Currently beetle infested tree would be monitored for and removed prior to beetle maturation and emergence.

The Horsethief Basin summer home project area was not visited during this trip, however the area was surveyed last year as part of the 2003 prevention/suppression evaluations. This area has high tree densities and is considered to be at a moderate to high susceptibility level with low levels of beetle activity in the project area. Adjacent areas have experienced high levels of beetle related pine mortality since 2001. Proposed treatments would include thinning and sanitation tree removal.



Figure 1. High Ponderosa pine densities in the proposed Cold Springs treatment area.



Figure 2. Current stand conditions in the Alto Pit OHV recreation site.

As part of this integrated pest management approach an interpretive/outreach program will continue to inform forest users of forest health issues and land management techniques that increase forest health. This will be accomplished through signs, brochures and forest staff talking with forest users.

Silvicultural Treatments for Reducing Bark Beetle Susceptibility

Management of bark beetle populations falls under two categories: direct action against the beetles themselves (suppression) or indirect action that addresses the general stand conditions (prevention). Direct action deals with the symptoms, too many beetles in one place at one time, and is aimed at directly reducing the number of beetles present. Indirect action focuses on the cause of the problem, which relates to optimal stand conditions for beetle buildup and outbreak. The only effective long-range strategy to minimize beetle-caused mortality is controlling stand conditions through silvicultural means over large areas and constant monitoring for areas of beetle buildup.

Silvicultural treatments are designed to increase tree vigor and reduce stand susceptibility to beetle attack through reducing basal area or controlling other stand conditions. They are preventive treatments that should be completed prior to stands experiencing beetle outbreaks. Stand hazard rating for *Dendroctonus* bark beetles of ponderosa pine involves measures of tree size, stand or group density (basal area), and the percent of host trees within the stand. No stand hazard rating models have been validated for pine engraver beetles species attacking ponderosa pine in Arizona, primarily because beetle populations are often driven by drought and factors leading to large amounts of slash. Stand hazard rating for *Dendroctonus* bark beetles attacking ponderosa pine typically involves measures of tree size, density (basal area or stand density index), and the percent of host trees within the stand. In general, ponderosa pine stands that have an average DBH greater than 12 inches and a basal greater than 120 ft²/acre are considered at high risk to bark beetle attack, stand basal area of 80 – 120 ft²/acre are moderate risk, and stand basal area less than 80 ft²/acre are considered low risk (Schmid and Mata, 1992; Chojnacky et al., 2000; Negrón et al., 2000).

Although no stand hazard rating system has been developed for bark beetles attacking ponderosa pine on the Bradshaw RD specifically, Munson and Anhold (1995) developed the following stand hazard rating system for mountain pine beetle in ponderosa pine (table below modified from Chojnacky et al., 2000). This hazard rating system was validated across several sites including the North Kaibab in Arizona.

<u>% PP</u>		<u>Ave. PP DBH</u>		<u>Basal Area (ft²/ac)</u>		<u>Composite Stand Hazard Values</u>	<u>Hazard Rating</u>
>85	(3)	>12	(3)	>120	(3)	8 – 9	High
50-85	(2)	8-12	(2)	80-120	(2)	5 – 7	Moderate
<50	(1)	<8	(1)	<80	(1)	3 – 4	Low

For prevention of western pine beetle attacks in California, thinning of dense, 70- to 80-year-old sawtimber stands is an effective silvicultural method for managers of both small and large holdings (DeMars and Roettgering, 1982). Demars and Roettgering (1982) state that by reducing stand stocking to 55 to 70 percent of the basal area needed for full site utilization will relieve the competitive stress among the residual trees, improve their vigor, and make them less prone to successful bark beetle attack.



Because of the more xeric conditions in the Arizona compared to other western states that have ponderosa pine, the low risk category may be even less than 80 ft²/acre. Also, because of the large complex of pine engraver beetles that typically cause the majority of ponderosa pine in the Arizona, average stand diameter may not be as important as other areas in the West where *Dendroctonus* beetles cause most of the tree mortality.

If thinning projects are undertaken, careful management of the slash is required while populations are high. Thinning will usually be most effective in areas that are not currently experiencing high levels of beetle activity. In general, population increases of pine engraver beetle can be minimized by implementing thinning projects after the onset of the monsoon season through December. Cutting trees during this season will allow the material to partially dry out before beetles fly in the spring. Also standing residual trees may be less susceptible during this time due to increased soil moisture caused by the monsoon rains. Slash generated from January through May typically remains moist and enhances beetle population increases. While this is a good general recommendation when beetle populations are relatively low, we have observed pine engraver beetles to complete at least one generation in slash generated during the fall of 2002 and 2003 on most Forests in Arizona. If this timing approach is being used, and trees are only lopped and left on untreated on the site, there are a couple points to consider. First, slash generated on more exposed areas that have relatively low residual basal area will likely dry out more by the time beetles fly in the spring. Second, on steeper slopes or where the residual basal area is still relatively high, slash may not adequately dry out by the time beetles fly in the spring.

Another general “rule of thumb” approach to preventing pine engraver beetles from impacting areas where thinning projects are being implemented is to separate project areas either in time and/or in space. Beetle populations probably will remain relatively low if thinning projects are conducted every other year. Similarly, a buffer of over two miles between management sites is also thought to prevent mass movement of beetles from one area to another. If thinning treatments are implemented in consecutive years, there likely will be a build up of pine engraver beetles that can move from one thinning project to the next.

The best preventive strategy to minimize pine engraver beetle activity related with thinning projects and associated slash is to utilize the larger diameter slash. Harvesting most ponderosa pine slash larger than 4 inches in diameter will help to prevent beetle populations increases because few beetles are produced in slash less than 4 inches because this material dries out quicker and there can be more competition for less food. The larger diameter slash should be removed from the site or treated within 28 days of being generated if thinning occurs during active beetle flight periods (April through early October). If thinning occurs during November through March, the larger diameter material should be removed or treated before the time beetles complete their first generation in the spring (i.e., by early May). If slash does become infested in April, removing or treating the newly infested material may aid in reducing the local population of pine engraver beetles.

Recommendations

Within the Alto Pit OHV and Granite Basin recreational sites I do not recommend any suppression activities because of the relatively low beetle population levels in these areas. However, preventative treatments to increase overall stand health and lower beetle susceptibility



is suggested. I would recommend a combination of sanitation and thinning. This would employ the removal of currently infested material in conjunction with the stand thinning. The removal of infested material will reduce the short term impacts, while the thinning will provide for the longer-term reduction of beetle susceptibility to the stand. Felling of infested trees will not kill developing brood. Infested trees must either be removed from the site or treated on site. Sound slash management practices should undertake.

The thinning projects in Cold Springs and Horsethief Basin should have a resulting basal area below 80 ft² per acres. This will help to reduce the overall susceptibility of the stands in the long term. Thinning from below has been experimentally demonstrated to increase the resistance level of the residual mature pine overstory (Feene et al., 1998). As mentioned above, thinning slash may pose a short-term risk to residual trees in the thinning units or surrounding areas depending on the timing of thinning, local populations of Ips, and site and environmental factors such as site quality and precipitation.

If you have any questions regarding this site visit, my assessment of current bark beetle activity, its potential effects on residual standing trees, or my recommendations, please let me know.

/s/ John Anhold
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cc: Gary C Wittman, Ian R Fox, Leonard Lucero, Debra Allen-Reid, Michael Manthei



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